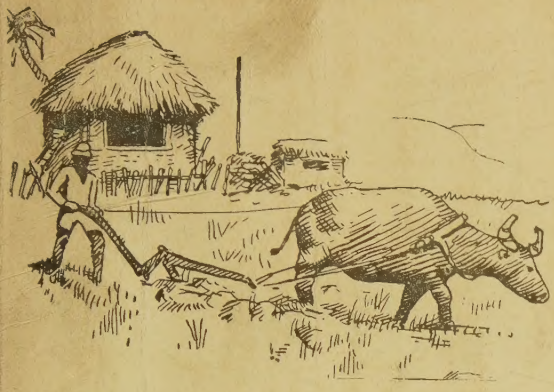
The Philippine Agriculturist and Forester



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THE STUDENT BODY OF THE COLLEGE OF AGRICULTURE

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THE STUDENT BODY OF THE PHILIPPINE COLLEGE OF AGRICULTURE

THE PHILIPPINE AGRICULTURIST AND FORESTER

Vol. I. JANUARY, 1911 No. 1.

SALUTATION

I have the honor and pleasure of introducing to the public the PHILIPPINE AGRICULTURIST AND FORESTER, published by the Student Body of the College of Agriculture. Whatever introduction the college itself may need—and it is still young enough to be moving into its first permanent buildings while this journal is in press—it will receive in the demonstration of its work in these pages.

The PHILIPPINE AGRICULTURIST AND FORESTER aims to cover in its activity the field of the college, promoting as it can the education of the Filipino people in agriculture and forestry, and the agricultural and forest interests of the Islands. The publishers are complimentary enough to believe that they will serve these ends by making the work of the college well known. Their journal will give first place to reports of the college work.

As the public schools are the natural means for the most general dissemination of agricultural information, a special attempt will be made to make this publication useful to teachers in the intermediate and high schools.

The demands upon agriculture and forestry are essentially the same in all parts of the Islands, but there are many differences in crops and in practice. Some of the differences depend upon the climate, and some have no reason. The mushroom culture of Pangasinan or Bulacan and the pandan industry of La Laguna would be valuable in every province. No one else with an agricultural education has such intimate knowledge of Philippine industry as these students. Their reports on this subject will be authoritative and valuable.

The potential agricultural resources of most of the countries in the Torrid Zone are very much alike. The information obtained by study and experience in one land is usually applicable in others; and since no government or people is able to give any full measure of profitable attention at once to the most of its own problems, it wastes a free opportunity for its domestic development if it fails to keep informed of what is done elsewhere. The students of the College of Agriculture receive this information by instruction in their classes, and at first hand by reading the agricultural publications of all tropical countries and the books and journals published elsewhere on the same subjects. Their organ expects to give a much wider circulation to the same knowledge, by the presentation of digests of the foreign work of the greatest local value.

Publications have a high birth rate, and a high death rate. They die for want of support, of some kind or other; and this is most often the result of their serving no sufficient purpose. I have encouraged the undertaking of this journal because I believe that it will be useful. While it is formally the organ of the Student Body, the college as an institution is back of it. Agricultural work already under way on the college farm will furnish the most of the material which the journal, with its present size, can publish.

—E. B. COPELAND.

THE COLLEGE OF AGRICULTURE

By Toribio N. Vibar.

A body of German farmers assembled about sixty-two years ago, and decided that they needed the help of investigation along agricultural lines to solve the problems by which they were confronted. This led to the establishment of the first agricultural experiment station in the world at the village of Moeckern, just outside of the city of Leipzig, Germany. The first American college of agriculture dates from about fifty-two years ago, and seventeen years later, the Connecticut Legislature passed an act which established the first agricultural experiment station in America.

These facts are interesting especially to friends of agricultural education. More interesting, however, to the Filipino people is the opening of the College of Agriculture, the first college of the University of the Philippines, on June 14, 1909, in the progressive town of Los Baños. On that date only twelve students were enrolled. The classes met for the first week in the houses of the faculty. During the latter part of that week, the students and some members of the faculty raised tents loaned by the Bureau of Education in the northwestern part of Camp Eldridge; and there, beginning with the second week, most of the classes were held. Classes in agronomy met in the houses of the instructors in charge. In the tents the teachers and students suffered great troubles, specially from the heat of the sun. During the first semester storms occurred, which blew the tents down several times; and as often the students raised them again. Then, other students came gradually; they were greatly surprised at the tents, which indeed presented an odd appearance for a college. The lack of seats made the students take their stools with them in going to their different classes. As I recall there was no single blackboard, at the beginning of the term, no tables or desks, nor a piece of apparatus, and not even a book.

We had the theoretical work in the town, but the practice was done on the College Farm, which is three kilometers from Los Baños. The land is typical of the Philippines; it is diversified, and permits the cultivation of all important Philippine crops. It is crossed by a river which will be used in the future to irrigate practically the entire farm. The practical work was very difficult for the students, for most of them had to walk about forty minutes and then work on the farm for nearly three hours, almost every afternoon. Many students were already disgusted and from crowds of weary farmers was often heard the murmur, "I can not endure the work; I'd better get out of this College." But not one left.

Troubles end, and about the third of October 1909, the temporary building on the College Farm was finished. The school was transferred on October fifth. The building consisted of two recitation and two laboratory rooms. It is of fairly strong materials, and was furnished with such apparatus as there was room for. The transfer greatly facilitated the practical work. We rejoiced that the discomfort of the tents had ceased, and were encouraged to continue our work in farming.

The dean authorized us to form a barrio on one side of the river near the new building. The barrio is a somewhat comical one, for the inhabitants are all men; no women are to be found. Here fraternity and union reign. The houses have their corresponding gardens, where the inhabitants raise crops for their own use. There are no boarding houses, but the students take care of their living and in the meantime learn to live economically. The cost of living of each student runs from twelve to fifteen pesos a month, but there are also those who spend even less than ten pesos. In the beginning the students had to spend about twenty-five pesos each for the erection of their houses. At first many of the town people were surprised when they saw us buying our food ourselves. They said that it was the first time they had seen students buying their own food and working as true workers; but many also said that it was good, because we would know in advance how to begin a new life and take care of the household.

During the school-year of 1909-1910, fifty six students were enrolled. Among them were twenty-four insular and a few municipal pensionados. Trips were made by the more advanced students for the purpose of investigation and study. Papers on "Coconut" and "The College of Agriculture" were presented by two students of this College in the Agricultural Conference of

February, 1910, in Manila, and another acted as interpreter. A paper entitled "The Cultivation of Corn" was also presented by our agronomist. Before the end of the year the College built up an herbarium of a thousand determined species, the best collection of fleshy fungi ever made in the Philippines, and fifty boxes of insects.

The faculty of the College of Agriculture for 1909-1910 was composed of the following members:

Dr. E. B. Copeland, Dean and Superintendent.

Mr. H. Cuzner, Farm Superintendent.

Mr. E. M. Ledyard, Instructor in Zoology and Secretary of the Faculty.

Mrs. C. S. Ledyard, Instructor in Modern Languages.

Mr. S. B. Durham, Instructor in Animal Husbandry.

All of them continue their work during the present year. Mr. R. M. Holman, now instructor in botany and chemistry, and Mr. M. Manas Cruz, foreman, became new members of the agricultural faculty. And a school of forestry has been established.

As to the Course of Instruction, I take the liberty of quoting the following from the catalogue of the College for 1909-1910.

First Year.		*Second Year.*	
English	I	English	II
Mathematics	I	Mathematics	II
German	I	German	II
Botany	I	Botany	II

Third Year.

Chemistry	I
Mathematics	III
Zoology	I
Agronomy	I

Fourth Year.		*Fifth Year.*	
Chemistry	II	Elective.	
Farm Engineering.		Physics.	
Agronomy	II	Agronomy	III
Zoology	II	Animal Husbandry	I

Sixth Year.

Elective	
Elective	
Agronomy	IV
Elective	

"There are offered as electives two additional years in Chemistry; one each in Farm Engineering, Animal Husbandry, and Botany; two years of Spanish; and any of the subjects described in the 'Course in Forestry.' Every candidate for graduation must have elected one course in Chemistry, Farm Engineering, or Animal Husbandry."

"Some of the courses in the first two years are identical with those given in the public high schools, while the work in other courses is more or less different. Credit will be given for work done elsewhere so far as it is a part of the College Course."

"Graduates from the six years course described above will receive the degree of Bachelor of Agriculture. Students who have graduated from a public high school, or who have received the degree of Bachelor of Arts, who subsequently meet the requirements for graduation from the six years course in agriculture will be granted the degree of Bachelor of Science in Agriculture."

The opening of the School of Forestry is another step towards the perfection of the institution. The course in Forestry covers four years. The work of the first two years is the same as that in agriculture, and for the last two years is as follows:

Junior Year.

First Semester.

Physiography and Soils.
Geometry.
Forest Botany.
Mapping.

Second Semester.

Physiography and Climatology of the Philippine Islands.
Trigonometry and Surveying.
Silvics.
Law and Procedure.

Vacation.

Lumbering.
Forest Mensuration.
Horses, Camps, and Packing.

Senior Year.

Wood Technology.
Surveying and Forest Engineering.
Silviculture.
Forest Economics.

Graduates of the four-years course in Forestry will be given a diploma, and employment without Civil Service examination. The Bureau of Forestry furnishes houses for all students in Forestry. This year the School of Forestry is under the care of Mr. R. F. Nash and Dr. Whitford. The students in Forestry have organized a society called the "Forest Club." A

German society has also been formed by students in German. The business meetings of the society are carried on entirely in the German language. All the students of this institution have organized themselves into an association named "The Student Body of the College Agriculture." Besides the Executive Board, the Student Body has committees on Athletics, Publication, Accounts, Domestic Improvement, and Social Affairs. Each committee is striving for the advancement of the institution. With the efforts of the committee on athletics a base-ball ground has been cleared and two base-ball teams have been organized, and furnished with a proper base-ball outfit bought by the Student Body. The School of Forestry has also established an excellent tennis court equipped with the necessary outfit. Our journal, of which this is the first number, comes into existence through the activity of the committee on publications. The committee on accounts considers all financial matters submitted to it. After consideration it presents them to the Student Body for approval or rejection. The Committee on Domestic Improvements works specially for the benefit of the college barrio. One of the present questions that confront the committee is "How may the students live cheaper?"

Although still in its infancy, the College of Agriculture has shown remarkable progress this year. Great trouble was found in reaching the College last year, but now an excellent road leads to it. The college barrio has been greatly improved by the addition of houses and better care of gardens and yards. Land of the college is rapidly being brought under cultivation by the students, whose number is now nearly one hundred. As every candidate for graduation must present a thesis, which must embody the results of his own work, theses on "Fertilizing Sugar-Cane," "Fertilizing Rice," and "Plant Stimuli" are in preparation. We have developed a beautiful nursery and many important crops are under experiment. The botanical and zoological collections have been increased and improved. Several work animals have been added to the number of last year. The College is now furnished with the necessary agricultural implements. Chemicals and chemical apparatus have already arrived and are now in use. A bodega has been constructed under the temporary building, and two concrete buildings are nearly finished: one of six recitation rooms, an assembly hall, and a library; the other a laboratory building of four main rooms. A silk house and a stable are in construction. Next year, the College will be able to receive five hundred students.

The Superintendent of the College is authorized to employ students for part of their time at ten centavos an hour. Students who are energetic enough can work and earn money for their living, meanwhile keeping up the regular college course. Perhaps, at no other college in the world can one secure a college education so cheaply as in the Philippine College of Agriculture.

COLLEGE STUDENTS ON A TRIP TO MT. BANAHAW

RICE GROWING IN PAMPANGA

By Felix Franco.

Rice, the bread of the Filipinos, has been grown in the archipelago from time immemorial, and its cultivation is still one of the chief occupations of the natives in every province. Its production which is yearly increasing lessens the money sent to foreign ports. The import of ₱23,097,628 in 1904 was reduced to ₱7,324,986 in 1907. Pangasinan leads all the other provinces in its production.

There are about one hundred and fifty varieties of rice in the islands, but the mimis, dinalaga, and quiring-quiring are of greatest importance on the irrigated lowlands where two crops are sometimes obtained in a year. The second, planted in January and reaped in March and April, is called *palacaya*. The binunduc and quinuayan are esteemed varieties on the high unirrigated lands and hill-sides.

The rice field is divided into small paddies or smaller called *libluban*. Each paddy is surrounded by low dikes called *pilapil* to keep the water on the farm equal. The paddies on an upland farm form terraces.

The land is plowed and harrowed with a harrow composed of thorny bamboo, called *balsa*, at the beginning of the rainy season—May, June and July. Then the seed is sown broadcast. This is called *salbag-malañgi*. In some cases the grain is soaked in water and kept in the sack for three days to germinate. When so treated it is broadcasted, as the former, in the field which is worked into soft mud. This is done to protect the seed from rotting when the land is flooded. This flooding which is called *palatac* is done during the months of June, July, and August.

For transplanting the land is also tilled while soft mud and is planted with young rice of six weeks (two or three plants in a hole) which is taken from small plots of nurseries called *pipamunlan*. Planting is done by men, women, and children, from early in June till late in October. Immediately after planting, the plants are very yellow and seem dying. But after a week or two they begin to revive and rapid growth follows. Maturity comes four or five months later. With this kind of treatment the best crop is obtained.

After sowing and planting no care is taken but to keep the paddies covered with water and cut the excessive leaves. The Igorrot system of cultivation is carried on along more scientific line; for irrigation, fertilization, and weeding are done.

Nothing is more interesting about rice culture in the Philippines than the primitive way of harvesting and thrashing.

Harvest time begins in December and lasts until March. The rice is cut by men, women, and children, and left scattered in the field for two or three days to dry. Then it is gathered into small sheaves called *tropas*. After two weeks these small heaps are gathered and formed into bigger ones called *buntun*. The buntun are left in the field unthrashed until a favorable time for thrashing comes.

Thrashing is done either by men or carabaos. Men do the thrashing in two ways:- the unthrashed rice is laid on mats of buri and trampled under their feet. Sometimes the rice is first placed (with the head up) against a pole and beaten by eight or ten men to separate a large per cent of the grain. Then it is trampled under their feet. In the other case a bundle of rice is struck against a cart. From four hours' work of ten men only three hundred liters of clean rice is obtained.

When carabaos are used, a gang of four or five are tied to a pole around which the rice is placed as before. A boy or a man drives the gang around the pole and the rice is trodden under their feet. In all cases the thrasher earns a comparatively small sum. From every seventy-five liters of clean rice he gets only seven and a half liters.

Winnowing is done by placing the rice (about five liters) on a flat basket and letting it fall little by little, so as to allow the chaff to separate by the help of the wind.

Sometimes the rice is thrashed by machines after the manner of thrashing grain in the United States.

The future of the islands is almost wholly involved in the development of their agricultural resources; the business of the islands depends upon how much the inhabitants, can get out of the ground. So the proper encouragement and protection of agricul-

ture; the utilization and conservation of the fertility of our soil; the presence of well-trained farmers, assuring well-directed labor; the giving up of our antiquated implements and weak animals and their replacement by modern machinery; and the cooperation of the natives for the proper utilization and manufacture of these products, all these are needed to insure the welfare and wealth of our people.

LEPTOCORISA ACUTA

By José Zamora

This insect, which attacks rice, causing thousands of dollars of damage, will not be a new one to Filipino rice planters, for it is known in almost all parts of the islands.

The diseased rice is said to be *inaatangia* in the tagalog region, *atangia* being the tagalog name for the insect. This pest bothers not only the Filipino farmers, but also farmers of many countries where rice is grown extensively, such as Burma, Assam, Bengal, The United Provinces and Madras, through the rice districts of Ceylon, the Malay Peninsula, the Malay Archipelago, China, etc.

The insect destroys beside rice other grasses, oranges, ripening seeds, millets, and plants with milky juice.

The Leptocorisa acuta is a slender green insect about two centimeters in length when adult. As protection it produces through its anal extremety a liquid with a very disagreeable odor. It lays its eggs in clusters of from four to ten on the surface of grass leaves while the crop is ripening, when there is plenty of food for the young bugs. This insect has practically no metamorphosis. After several days one end of the outer shell of the eggs and also the inner membrane break and liberate the young bugs, which have then slender black legs and feelers and green bodies. Their antennae are banded in black, white, and brown.

The gross symptom of rice attacked by these insects is the whitening of the heads. The sucked grain shows a black spot at the place the bug introduced its proboscis, which enables one to recognize the attacked grain before the whitening of the whole head.

In India several methods have been employed to eradicate this insect, but none of them has given good enough results to recommend it for general practice. One of their methods, for example, is to get bags eight feet wide, three feet deep with three feet wide opening, which are brushed around the rice plants. Many of the bugs are thus caught, and they are then crushed and killed. The method does more damage than good, for the plants being then in fruit are naturally heavy at their tops, and their tendency to bend is more accentuated by the brushing, with the result that the heads bend too low so as to be within the reach of rats and frogs. Moreover the farmers in thus catching the insects may step on the plants and ruin them altogether.

Another method is to smear a paddy winnow with sticky fruit juice. This is fixed to a pole and is waved in the field. This method seems to be useless, for the insects do not fly high away from the plants, but they jump from head to head and stay among the plants all the time.

The pest is really a hard thing to fight, for the bugs are not found in small bunches, but they occur in great numbers scattered all around the plantation. The use of chemicals has not proven successful. Carbon bisulphide and other gaseous poisons have been tried once, but the experiment failed, because the gas diffused rapidly into the air and did not have any poisonous effect on the insect. Smoking has also been done, but the smoke was not able to penetrate to the lower part of the plants where the bugs hid themselves.

Two methods of eradicating the pest were found by the writer to give good results, one being the use of kerosene emulsion and the other, the use of rotten animal matter.

The bugs when just hatched are in bunches of from forty to sixty, and are very easily killed by a contact poison such as kerosene emulsion. In applying this emulsion, care should be taken that the plants are not

shaken much for the bugs would otherwise drop to the ground and escape from the action of the poison. The method is not economical nor it is easy on a large scale.

For the other method, which has been found to be more practical by many farmers, any kind of putrified animal matter will do. This rotten animal matter is placed in canes with a bit of wax, and the canes are hung on poles stuck into the ground at regular distances of from ten to twenty meters. The repulsive odor of the rotten animal matter drives the bugs away, and thus keeps the plantation free of the pest.

THE VALUE OF A VEGETABLE GARDEN

In the Philippines, vegetable gardening is yet in its infancy, although much interest has already been given to it by the Bureau of Education, and the Bureau of Agriculture. In some provinces, however, it receives great attention. In others, it is almost neglected. The people raise vegetables only to a very small extent not even enough to satisfy the need of their families. More attention is given to the cultivation of decorative plants especially in towns. Vegetable gardening seems of minor importance; but if we estimate the amount of vegetables consumed by the people every day, we will be convinced of its value.

Any school where gardening is taught should have a vegetable garden; else difficulties in running the classes will be found for lack of illustrative materials, moreover, the advantage, and value of practical garden work will make the work practically valueless. A vegetable garden is primarily a laboratory for the school; it is a place where the pupils can learn the lives of plants; the influence of cultivation upon crops, etc. It gives us object lessons. It serves as a place for recreation, and beautifies not only the school but the town also, in which it is a little demonstration farm, which thereafter will be followed by gardens of the community. From the garden, the pupils, acquire knowledge of the soil and of the lives of plants, and the importance of their products. Their interest is led to the cultivation of plants, they learn how to work, and consequently appreciate labor. Their power of observation is strengthened, and they are prepared for higher scientific studies. Each pupil is stimulated to establish a garden in his home naturally trying to make his better than his neighbors'. They, then, learn how to become independent, and realize the self-respect which goes with ownership.

Unless one's knowledge has been obtained from his or her experience, it is not very conclusive and effective. Studies in books only give information, but do not train the pupils in efficiency. The pupils, therefore, must be helped to apply their brain, by themselves, and practically, to the details of the garden work. They must understand and make use of their understanding of the growth of plants; the time of flowering and maturity of crops; and the response of plants to the surroundings. In studying certain crops, the information on them in books is helpful; but it must be supplemented by studying the plants fresh in the garden. After studying the shoot, the plants may better be pulled to study the roots and their arrangement. The school is not after the profit from the plants; but it is after useful information, which it can give the pupils and the public. Information is not useful until it is applied.

The vegetable garden is a source of both food and pleasure. A person possessing a vegetable garden is generally a healthy one. He needs not buy vegetables; for he has them fresh, clean, and free from dreaded infectious diseases. On the contrary, he may sell his surplus, and get the money of others into his pocket. He is to a great extent independent. A great advantage is that he is free from local disease apt to form by the vegetables sold in markets or stores. Vegetables of the latter kind have passed many hands. They may be bruised, and lose their natural flavor. But those of the garden are generally sound. The gardener may harvest his vegetables only at the right age or in whatever age he wants them, to suit his desire. The amount of vegetables expected from a garden of course depends on the area in cultivation and on the treatment of the crop. "A half acre devoted to the various kinds of garden crops will easily supply a family with $100 worth of

vegetables during the year," says Mr. W. R. Beatie's "The Home Vegetable Garden."

What would happen to the Philippines if even one-fourth of the families would have each a vegetable garden? In the first place, we would stop importing vegetables from other countries, and keep at home the money now exported for them.

The comfort of a people is generally determined by the way they provide for their necessities. Foremost among these necessities is food, which is directly or indirectly derived from the soil, found where all people live. In the Philippines there is enough good soil, and any ambitious family can easily have a vegetable garden. The garden does not require great attention after it has been properly started, and to start the garden does not involve a toilsome labor; at any rate is not toilsome unless one feels that way about it. We know already that it furnishes us with food, why not strive we to have one. To establish a garden is discouraging in the beginning, especially if one focuses the labor of a month on the attention of an hour but afterwards the labor will be found to be pleasing. It is a pleasure to see the crops when already growing; and more of a pleasure when they furnish one with food.

A growing interest is being demonstrated in school gardening by the public school of these islands. We are glad of this, and hope that still more stress will be laid on it, so that the raising generation will have a PROFITABLE realization of our necessity for Agriculture, the most important basis—if not the sole one—of our wealth, and comfort.—T. N. V.

COLLEGE STUDENTS PLOWING IN THE COLLEGE FARM

THE PANDAN INDUSTRY IN MAJAYJAY

The following notes are a summary of information obtained from Señor Eustaquio Brioso, Municipal President of Majayjay, Señora Rafaela Diaz, and Señor Meliton Estrellado, who are all owners of pandan plantations, and from several mat-makers, and from personal observation.

Majayjay is on the northeast slope of Mount Banahaw and is therefore a rolling country. It has a humid climate, and is well supplied with rivers and springs. While pandan (Pandanus utilissimus, Elmer) grows as well in Lilio and in other neighboring towns as in Majayjay, mat-making seems to be restricted to the latter, and in this largely to the barrios of Bakiw, Oobin, and Balayong, on its south and southwest side.

Pandan is not grown on a considerable scale by any single owner, but many of those, who have mat-making for their occupation, combine to have a small plantation of pandans to furnish their supply of leaves. There are also others who raise pandan on their idle lands, and sell the leaves to mat-makers, at the rate of forty to fifty centavos per hundred, the cost of gathering charged to the buyer. In no case are they grown regularly and on a commercial scale, but suckers are stuck wherever there is room for them.

Pandan demands a rich loamy soil with a good supply of moisture, and makes a thrifty growth in grooves and forests. But it will not grow where there is stagnant water. It is particularly adapted to hill-sides where there is constantly moving water in the ground.

The plant is propagated by means of suckers. Planting is done during the rainy season. There is diversity of opinion as to whether its seeds germinate or not, but the probabilities are that they do. The suckers are stuck into the ground to a depth of about three inches or less according to their size, and at irregular distances, ranging from less than one meter to three meters and even more. No special preparation of the soil is made before planting, but at the time of planting the shrubs where the suckers are to be put are cleared away so as not to interfere with the young plants. The soil around these is tilled now and then so as to give them a good start, and the old leaves are cut off and buried around them, to serve as fertilizer. In planting the suckers, care should be taken that the bases of the young leaves are not covered with earth, for the plant is then likely to die. After the young plants have gained a foothold in the ground, they are left entirely to themselves.

The first crop of leaves can be obtained when the plants are about two years of age, and from such leaves mats, one meter by two meters, are made. As the plants get older, longer leaves, from three to five meters in length, can be obtained, and larger mats made from them. The yield per tree is about three to five leaves, when gathered every three to six weeks, the number and the time between cuttings varying with the age and thrift of the tree. Only mature leaves are gathered in every case. The leaves are cut flush with the stem so as to facilitate the gathering of the next crop, and to prevent the collection of dirt around the bases of the younger leaves. After cutting the leaves from the trunk, their edges and midrib are removed and they are then put in the sun to wilt. Then they are cut into strips of the desired width and put out to wilt farther, but not to dry. The devise used in cutting to the desired size consists of a piece of leather, two by forteen centimeters, folded on the middle; a knife is cut into one edge of the folded leather and as near the fold as to leave an opening having the same width as that of the desired strips. The leaf is then pulled between the flaps of the leather, and a strip of the desired width is thus cut from it.

The strips after wilting are softened in a sort of mill made up of a cylindrical piece of wood about three meters long and forty centimeters in diameter, provided at the

middle with two heavy pieces of stone to increase the weight of the cylinder; the two ends of this rest on platforms, on one of which the strips of pandan are put and made pliable by turning the cylinder to and fro. A handle is attached to the end of the cylinder to facilitate rocking it. When softened and pliable, the strips are ready to be woven into mats. About forty leaves of mixed sizes are necessary for a mat two meters by two meters forty centimeters, and mats of this size are worth from two to three pesos, the price varying with the season of the year, and the amount of decoration. A good worker weaves a mat of the size mentioned in a little less than twelve hours, but for the average workers, forteen hours or more are necessary. During the dry season, mats are cheaper and whiter, for work is then cheaper and the mats are easily dried white in the sun.

The mats are decorated with capricious designs made up of strips of *buri* leaves, tinted pinkish red ordinarily, and interwoven with the pandan strips of the mat. The red *buri* leaves are obtained as follows: the leaves are gathered and immediately boiled in hot water; then they are put out to dry in the sun, and then soaked in cold water, and dried again. They are afterwards steeped in an emulsion of *culis* leaves, (Memecylon edule); the *buri* is left in the emulsion for four days. After drying the *buri* has a yellow appearance. It is then boiled in water, together with sapang wood (Caesalpinia sepiaria). When the liquid is pinkish red, the *buri* is taken out and wound on bamboo to dry, and then rolled into coils and kept for use. Other colors are made from dyes bought from Manila.

Besides mats, hats and baskets are also made from pandan leaves, but pandan is now being replaced by *buri* for hat-making in that locality. The coarse leaves of pandan are made into baskets, the fine and more flexible ones being reserved for mat-making.

The extent of this industry is shown by the fact that most of the mats used by the people of Laguna, Batangas, Tayabas, and Cavite, are furnished for the most of the year by Majayjay. There are also some brought to Manila.

About fifty suckers of pandan have been obtained from Majayjay and planted on the college farm. This will give an opportunity for the first careful study of the cultivation of this useful but little known plant.

M. R.

The breeding herd of Nellore cattle which the Bureau of Agriculture found it impossible to keep in even fair condition in Trinidad has been turned over on memorandum receipt to the College of Agriculture; it has since shown very satisfactory improvement. The Bureau's La Carlota herd has always kept in good condition. There has been enough experience with these herds to establish the fact that this large and handsome breed will thrive at low altitudes in the Philippines, but not in the Benguet highland.

Mr. Ledyard has offered several prizes to his classes in entomology, to students who succeed in working out certain unknown points in the life-history of coconut beetles. Mr. Cuzner has offered a prize to the student in Agronomy I who presents the best study of cane.

The academic building of the College of Agriculture is being furnished throughout with narra in natural finish making it the most beautifully furnished edifice of its kind in the Islands.

Blas Velez and Francisco Quisumbing, of the entomology class, spent the Holidays at the Bureau of Science in Manila, getting practical experience in the culture of silk worms. The college silk house is in their immediate charge, under Mr. Ledyard's direction.

Some Practical Advice on Horse Breeding in the Philippines

By S. B. Durham.

The Philippine pony is supposed to have originated from the Andalusian horse and the Chinese mare. It is obvious that from time to time more or less Arabian blood has been introduced, and evidence supporting this fact is to be noted in horses from Batangas and one or two other provinces in the Islands. The native horse, as a rule, is swift, strong, and elegant; and, when properly cared for, his powers of endurance are admirable. The weak points of the native horse are an almost universal lack of gaskin measurement and poorly formed forelegs. As a rule the shoulders are well formed. This good quality is not universal, but it is certainly worthy of comment since practically all breeds of ponies have a tendency to revert to the light shoulders.

All importations of Spanish, Australian, and American horses to improve the native pony have resulted in failure. This no doubt is principally due to the fact that too great differences in size and other characteristics exist between the animals imported and the native stock. The progeny, as could be expected, were possessed of no type whatever, but on the other hand could probably be called "sports," since they usually preserve some of the characteristics of both sire and dam which render them unsymmetrical. For example, a direct cross of a standard horse on the native stock might produce an animal larger than the dam in body but with practically the same feet and limbs. Again, one can often see the result of such a cross in the long forearm, the characteristic of the sire, and the short common bone from the pony dam. Disregarding this lack of type in the offspring, there still remains the fact that constitution has invariably been sacrificed for size.

The ordinary "cochero" has no notion of the proper treatment of ponies, his idea being generally that this exceedingly nervous animal can be managed by harsh treatment and the infliction of severe punishment. The average native pony has plenty of nerve and ambition, and if properly fed and handled, would never need to be touched with a whip. Kind treatment goes much further with him than ill-treatment. A man attempting to drive a young horse should get the idea that he is educating him, and that an education can not he hammered into his brain or forced upon him in a day. Give the horse credit for having some sense, some feeling, and the right to proper consideration. Do not insult him. It is never necessary to have a balky horse if he always gets the right kind of treatment. This vice is usually brought on by the owner in two different ways. First, an attempt is made to force the horse to do a task that he knows nothing about, he is whipped, and, very naturally, the next time his education is no further advanced than in the beginning, Second, a horse when young is many times forced to do more than he should, and herefore becomes discouraged and refuses to obey. After he has become discouraged two or three times he sees that by stopping he can get out of a task and many times becomes so stubborn that he will willingly submit to punishment rather than obey the slightest wish of the owner whom he has by this time learned to despise. The old proverb: "An ounce of prevention is worth a pound of cure," certainly applies here.

"In deciding the question as to what is the best type of sire to use as a first cross on Philippine mares" in the words of Mr. Austin, a breeder of wide experience with light horses, "we may narrow the subject of the selection of the breed most adapted to this purpose to the following: "Welsh pony, Thoroughbred, English Hackney, and Arabian." Mr. Austin chooses the Welsh pony as the one best suited to meet the above purpose. This breed has long been bred in Wales, and at the present time is more popular than ever before. Years ago they were improved somewhat by Arab and thoroughbred blood, but compared with other breeds mentioned, excepting the Arab, they have been bred in a more natural way, and when crossed on other stock, stamp their characteristics with great regularity. Objection is sometimes made to them, the claim being that they do not possess sufficient action for a pony breed, but the writer has seen them on different occasions, at the International

Live Stock Show at Chicago, and at the St. Louis exhibit in 1904, and has never noted any justifiable criticism in this respect. They possess good style and are suited to driving or riding. Specimens of this breed usually show plenty of speed and quick, strong knee and hock action. They are, however, not as good as the English Hackney in this respect. They are celebrated for their strength and endurance and for persistently breeding true to type. The claim is made for them that they are as good in this last respect as the Southdown sheep when crossed with grade or mountain types. These ponies have given good results when used in studs in Australia and some of the tropical countries. They are able to withstand unfavorable conditions under which the Thoroughbred or Hackney would more than likely fail. In selecting a sire, one that has been proven to be of the best should be chosen, and during the first year here he should be limited to only 20 or 25 mares.

Arab horses have long been known for their strength and endurance. Their native home is Arabia and the best specimens are said to come from the desert regions. The value of the Arab for crossing is unequaled. Wherever used it transmits constitution, quality, and style in a marked degree. Breeders in different countries still use the Arab cross when their stock is "run down," or when depleted. This breed was used extensively in early times to form the foundation stock of the Thoroughbred, English Hackney, and even some of the draft breeds. Government Arabian studs have been kept in France, England, Germany, and other European countries. The object in using them, however, has invariably been to instill constitution, vigor, and refinement into foundation stock. They seem specially good for crossing on stock having coarse, inferior bone. In no instance so far as is known by the writer has the claim been made that the Arab possesses merit in adhering to type when crossed on other stock, and authentic statements disclaiming such characteristics are common. This would seem to be obvious since in European countries his use has been discontinued after the desirable characters are procured.

The Hackney pony is of the same breeding as the English Hackney Coach horse, in fact he is a hackney under 14¼ hands in height. This breed has of late gained much reputation on account of its ability to "show up well" in the show ring. In fact Hackneys have been pampered for this purpose until it is a question as to whether or not they could be depended upon to withstand unfavorable conditions.

The Thoroughbred pony has been given special classes during late years in the principal show rings. The pony class comprises all Thoroughbreds under 14¼ hands in height. This type of the English race horse has met with favor recently for breeding polo ponies when crossed upon New Forrest Exmoor or Welsh ponies. The value of the Thoroughbred for crossing and improving has been well demonstrated and this breed is at the present time being used as a cross on stock to "breed out" coarseness and to promote symmetry and swiftness.

In studying the conditions in the Philippines we must at once decide that the all important quality of the sire used as a first cross on native mares must be that of adhering to type. This we could not expect from the Arab horse or the Hackney, but it does not follow that each of them may not have their own part to play in establishing a breed here. We could reasonably expect the Welsh pony to produce type in the offspring and the main strain of foreign blood should come from this source.

A plan suggested by Mr. Austin and which the writer believes to be a most feasible one is as follows:

Select mares which have some Arabian blood in them and are specially good in gaskin and knees and possessed of sound compact shoulders and body. Some of these are to be crossed with a Welsh stallion and some with a small Thoroughbred chosen for his good muscle and symmetry, rather than speed. The horse colts of such a progeny should be castrated when sex characteristics appear and the mares when old enough for breeding purposes should be crossed with newly imported Welsh and Thoroughbred sires; the native-Welsh with the Thoroughbred and the native-Thoroughbred with the Welsh. A limited amount of Hackney blood might be used to advantage after a period of a few years, to breed out the coarseness and to favor symmetry and size. This, however, should be expected of the Thoroughbred, and the advisability of such a step must be determined by the breeder himself after he has started the work.

THE MAKILING FOREST RESERVE

The completion of the concrete buildings of the college is hardly a more important event in the history of the institution than the establishment of the Maquiling Forest Reserve. This places as fully at the disposal of the school of forestry as if it were made a part of the campus a diversified forest of more than three thousand hectares. Such opportunity for work and observation make the position of this school unique.

The reserve is also of the greatest importance to the agricultural work of the college. There are a few crops of the Islands, and others which ought to be of the Islands, which demand mountain conditions. The culture of cinchona and tea want attention, and there is a chance to test them at various altitudes on Mt. Maquiling. The establishment of the reserve guarantees the safety and permanence of such experiments.

The possession of a botanic garden has from before the beginning been one of the hopes of the college. Something has of course already been done toward it, and the gorge of the stream on the campus would furnish room for a very good one. The forest reservation of the mountain provides an opportunity for the development of as fine a garden as there is in the world, and a great deal of the material.

BY THE GOVERNOR-GENERAL OF THE PHILIPPINE ISLANDS—A PROCLAMATION

No. 106

Whereas, the Director of Forestry recommends, with the approval of the Secretary of the Interior, that a certain parcel of public domain on Mount Maquiling in La Laguna and Batangas Provinces be set aside as a forest reserve:

Now, therefore, I, W. Cameron Forbes, Governor-General of the Philippine Islands, pursuant to the provisions of section four of Act Numbered Eleven hundred and forty-eight, entitled "An Act to regulate the use of the public forests and forest reserves in the Philippine Islands and repealing General Orders, Numbered Ninety-two, series of nineteen hundred, Act Numbered Two hundred and seventy-four, and sections twenty of Act Numbered Forty-nine, eleven of Act Numbered One hundred and nineteen, and eleven of Act Numbered One hundred and twenty," do hereby set apart from the public lands and withdraw from sale or settlement the following described parcel of public domain, which is hereby established as a forest reserve, hereafter to be known as The Maquiling Forest Reserve, in the municipalities of Los Baños, Province of La Laguna, and Santo Tomas, Province of Batangas, Island of Luzon, to wit:

(Here follows a detailed description of the boundary, with the location of 181 points in it.)

Containing 37,675,323 square meters.

Points 4, 6, 7, 8, and 9 are P. L. S.-B. L. monuments; points 20 to 49, inclusive, in centers of creeks.

Bounded on northeast by military reservation, properties of Santiago de los Reyes, Ignacio Manzanilla, Bonifacio Luntoc, Faustino Pantua, Gregorio Sapin, Agricultural School, creeks, properties of Segundo Pandiño, Andres Tandang, Faustino de la Cruz, Domingo Valentino, Lucendo Mercado, Feliciano Navarete, Juan Amutan, Pedro Burgos, Hermogenes Eusebio, Santiago de los Reyes, and Paciano Rizal; on southeast by properties of Paciano Rizal, Cosme Capuno, Delfin Marienito, Justo Ramos, Saturnino Jamplasan, Santiago Malagno, and Hacienda de Calamba; on southwest by properties of Susana Mercado, Miguel Malvar, Anastacio Maloles, Marcos Maloles, Miguel Malvar, Simprosa Mayuga, Miguel Malvar, Juan Sanchez, and Miguel Malvar; on northwest by property of Miguel Malvar, Calamba Estate, properties of Mauro Prieto, Ciriaca Arguelles, and military reservation.

Bearings true. Variation, 0° 56′ E.

Points referred to marked on plan Ipd-11, on file in the Bureau of Lands.

Surveyed October 29, 1909, to January 29, 1910. Approved, August 17, 1910.

In witness whereof I have hereunto set my hand and caused the seal of the Government of the Philippine Islands to be affixed.

Done at the City of Manila this twenty-first day of November, nineteen hundred and ten.

W. CAMERON FORBES,
[SEAL] *Governor-General.*

By the Governor-General:

THOMAS CARY WELCH, *Acting Executive Secretary.*

The Philippine Agriculturist and Forester

Organ of the Student Body of the Philippine College of Agriculture Published Monthly During the School-year

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SUMMER COURSES

There is no reason that an expensive educational plant should be permitted to lie idle for ten weeks at a time every year. Neither is it reasonable that teaching of agriculture should cease for a certain time every year; the practice of agriculture has no vacation. It is probable that at no distant date the course of the college will be so modified that every student will spend April and May of one year in attendance. The course in forestry already provides work during one long vacation, and the agricultural faculty is gradually being put on the accrued leave status.

During the coming vacation, courses will be given in botany, and in any agronomic line for which there is sufficient demand. The course in botany is especially important to students who expect to enter with advanced standing. All such students bringing credit for more than one year are of necessity behind the classes they would enter, in not having taken the second year in botany; and most of them have not had the first year as it should be taken. It is strongly recommended to all such prospective students that they present themselves at Los Baños at the beginning of the vacation. By devoting all their time to the one subject, they can compress the year's course into the weeks before the college year regularly begins.

There are the same reasons for offering vacation work in German, but this is not practicable this year.

UNIVERSITY NEWS

The Vice-Governor, Judge Newton W. Gilbert, who has acted as President of the University since its establishment, and who is chiefly responsible for its rapid and substantial development, will be absent on leave a large part of this year. His Excellency, the Governor-General, assumes Judge Gilbert's duties.

The Speaker of the Assembly has named as chairman of the committee on public instruction Mr. Emiliano Tria Tirona of Cavite, who becomes *ex officio* a member of the Board of Regents. The vacancy resulting from the expiration of the term of Mr. Mendiola is filled by the appointment of Mr. José Escaler.

Mr. Horace G. Deming, of the University of Wisconsin, has been elected Associate Professor of Chemistry in the College of Agriculture. His service will begin with the next college year.

The Bureau of Forestry proposes to move its Division of Forest Investigation to Los Baños, the work of the course in forestry in the college to be divided among the staff of the division. This will bring the instruction in the course in forestry up the highest grade. At the same time, it will probably make the corps of botanists at Los Baños the strongest at any one place in the Tropics.

In the College of Liberal Arts, Dr. L. E. Griffin, hitherto of the College of Medicine, will become acting dean in succession to Mr. Beattie, who resigns at the end of this year. Mr. Salt has been elected Assistant Professor of History. Dr. Griffin and Mr. Salt are preparing the university catalogue, which will be issued in March.

CURRENT LITERATURE

ACTIVITIES OF THE HAWAII AGRICULTURAL EXPERIMENT STATION.

The Government of the Dutch East Indies must be given the honor of having maintained the most advanced activity in tropical agriculture. With its established prestige, its corps of trained scientists engaged in research, the facilities of every kind built up by years of successful effort, and its stations scattered over Java, in which the Government makes its tests and demonstrations on the planters' scale, Java is a strong candidate for the same premier rank in the years to come. The Philippines are in the list. British colonies are already in the front in single lines. France and Germany, trained at home to eminence in intensive agriculture, are striving to bring their colonies to the front. But the foremost rival of Java to-day is Hawaii.

In and near the little city of Honolulu are the territorial experiment station, the sugar planters' station,—an institution paying more than one hundred twenty thousand pesos a year in salaries to men engaged in investigations of the sugar industry,—the College of Hawaii, and the Hawaii Agricultural Experiment Station, locally known as the Federal Station. The last of these has published within the past year its Annual Report for 1909, Bulletins on Shield Budding the Mango and on the Composition of the Rice Plant, and Press Bulletins on the Influence of Manganese on the Growth of Pineapples, on Cotton Experiment, on the Use of Carbon Bisulphide in Killing Weeds, and on the Algaroba.

The Annual Report is a general summary of the work of the station. We quote from its introduction:

"During the past year gratifying success has been had in developing a substantial interest in the diversification of agriculture in the territory. The apparent hesitation which has frequently been shown by citizens of the terrritory in engaging in general lines of agriculture has evidently been due not to any doubt as to the possibility of raising a great variety of crops, but to a lack of specific experimental data as to where the best seed may be obtained, the best cultural methods for these crops, and facilities for marketing them."

This is probably the case in the Philippines, where all the products which are now under extensive cultivation in the Hawaiian Islands should thrive at least as well as there. The advantages of diversified agriculture are found not only in what it pays to raise the crop, in the saving in the cost of transportation, and in the greater measure of local economic independence, but also in the benefits derived from the system of rotation developed along with it. A diversified agriculture would mean in the Philippines the prevention of a large share of the exhaustion of the soil which results from the present general persistent planting of one crop in each place. Perhaps by showing the people the market possibilities of such crops as pineapple, cotton, cassava, rubber, and many garden and forage crops, they could be induced to practice rotation, and indirectly increase the profit from the present staple crops.

The Hawaiian Experiment Station is undertaking investigations along chemical, entomological, horticultural, and agronomic lines, but it has devoted special attention to the study of the citrus fruits, mango, rice, cotton and rubber.

CITRUS FRUITS.

The chief object of the investigation of citrus fruits has been the determination of the best method of propagation. The methods of budding used were those common in citrus culture and known as "shield budding" with a "T" shaped incision, with an inverted "T," and with right-angled and curved incisions. The two latter were used only with angular bud-wood and the curved incision was adopted only in old bark. The tying may be done with raffia or strips of cotton which have been dipped in melted wax. If the latter are used, they should be held tightly in place by twisting together the ends. The use of these methods of budding has discovered the causes that are responsible for the many reported failures. These causes are poor bud-wood, lack of vigor in the stocks, and insect attack. A vigorous healthy condition in the stocks is necessary for successful budding. Anything therefore, that would tend to impair that condition, whether it be infertility of soil, insufficiency of moisture, insects or diseases, must be removed. The bud-wood should be well matured and from a healthy growth. If selected before the most active growth, in spring, it can be preserved in sphagnum

moss, soaked in water and wrung out as dry as possible, until wanted. It will be necessary to moisten the moss by removing it from the bud-wood and dipping it in water every two or three weeks. Scale insects and mealy bugs (mainly Pseudococcus filamentosus, the purple scale, and the Florida red) are the "most prolific source of trouble." The pests are remedied with fumigations with hydrocyanic acid gas and are also greatly held in check by ladybirds or Coccinelids.

WINDBREAKS.

A study of materials for windbreaks for orchards leads to the following recommendations, which should be valued in this land of frequent baguios:

A row of Eucalyptus robusta are planted on the outside, and a row of Monterey cypress (Cupressus macrocarpa), within. The trees in each row are about eight feet apart and the Monterey cypress stand opposite the open space between the Eucalyptus. By these two species, the Eucalyptus running rapidly upwards, and the cypress being a dense growth near the ground, an effective windbreak is provided. Where these species would not grow the madrecacao may take the place of the cypress and tamarind that of Eucalyptus; but large trees of Eucalyptus in Manila took the full force of the baguio of September, 1905, without the least injury.

SHIELD BUDDING THE MANGO.

The advantages of growing mango in the tropics for the world's markets are so obvious that its propagation should be taken care of, and made more expeditious. Satisfactory results were had in Hawaii as to the present knowledge of mango propagation.

The method described is not essentially new. It is only shield budding with "T" inverted, adapted to the mango's peculiarities. Shield budding being very old and widely applied, has been practiced on the mango for years following the selection of bud-wood and stock as applied to citrus fruits. This method because of unsuccessful results gave way to the patch bud, practiced with bud-wood and stock more mature. The proposed method uses the same maturity, but is simpler, bringing, as it does bring, the bud-shield into contact with the stock as in ordinary "shield budding" with an inverted "T" incision.

The tool materials fitted for the work, are: 1—budding knife, to make the incisions, with bone handle to raise the bark; 2—raffia, for tying the material firmly for the time necessary, without cutting the bark; 3—grafting wax (beeswax, two parts, resin, two parts, beef tallow, one part, by weight); and 4—waxed cotton bandage.

Shield budding is successfully performed on stocks one to three inches in diameter on seedling trees two to five years old. For the bark to separate, the stocks should be in a thrifty condition and in "flush." The best time is when the terminal buds are just opening. The bud-wood has also been successfully used, this being one which has lost most leaves and is turning brown or gray. The incision should be six inches long and curved. The bud is removed from the bud-wood, is inserted in the stock, and then the tying and wrapping are done. The after treatment consists in lapping the stock after three to four weeks to force the bud to grow. As soon as the bud has grown, the top of the tree may be done away with.

Shield-budding can be set with speed and is applicable to seedlings most advantageously. In budding, bud union is possible only in an elliptical line between bark and the part adhering to the bud shield. By cutting a branch above a bud, the latter grows through the elongation of the cells, and if a new bud be inserted under the bark of that branch, provided union takes place, a homologous change in the direction of the grain is effected. While at times an adaptation of inarching is tedious, it is not very uncommon to have it serve successfully.

RICE.

In a fertilizer experiment with rice it was found that two hundred pounds per acre (222.2 Kg. per hectare) of a complete fertilizer having the composition:

6 per cent nitrogen (3 per cent organic, as fish guano, 3 per cent as sulphate of ammonia).

9 per cent phosphoric acid (4 per cent as water soluble, 5 per cent as reverted).

10 per cent potash, as sulphate of potash, and having a net cost of $8.70 per acre (₱43.50 per hectare) to which transportation and cost of application ($1.30 per acre or ₱4.25 per hectare) are to be added, gave practically as large yield of paddy as did greater quantities up to eight hundred pounds. Moreover, the results were approximately the same whether applied before the crop was planted or afterward.

A very interesting experiment has been performed to determine the effect of fertilizers on the composition of rice in its different stages of development. The following is an extract from Bulletin No. 21 on that subject:

Ten plats of one-fortieth acre each were chosen and treated as follows: three plats were not fertilized, forming, therefore, checks; the remaining seven each received different fertilizers, using the single elements on some, on others various combinations. Nitrogen, in the form of ammonium sulphate, was applied at the rate of sixty pounds of nitrogen per acre, phosphoric acid as superphosphate at the rate of forty-five pounds of phosphoric acid per acre, and potash as sulphate, at the rate of sixty pounds of potash per acre. No lime was applied, since previous tests failed to indicate its need. After thorough preparation, the soil was flooded and left partially submerged for several days, after which the fertilizers were applied to the wet soil, thoroughly mixed with the same by hand, and then completely submerged with a very pure artesian water, in which condition it was maintained throughout the experiment, with the single exception of a period of about five days during the flowering period. The water at this time was shut off in order to hasten backward fruiting stems and insure uniformity in ripening.

The samples for analysis were gathered from each plat at three different stages of development of the plant. The first series were drawn forty four days from the time of transplanting, or previous to the formation of flowers, transplanting having been done when the seedlings were from twenty to thirty days old; the second series, at the time of full flowering; and the third, at full maturity and normal harvest. All these samples were carefully uprooted to secure the entire plant, roots and all.

The experiment has been made with two different crops of rice, one with the spring, and the other with the fall crop. The following results have been drawn, as conclusions, from the analysis of the samples obtained as above mentioned. The summary of the results is as follows:

1. Fertilization with nitrogen, either with or without minerals, greatly increased the growth of the rice at all periods of its development. Minerals alone, or in conjunction with nitrogen, slightly increased the growth in the spring crop, but in the fall a corresponding decrease attended this application.

2. The percentage of nitrogen in the dry matter, at the first harvest of each crop, was considerably increased by nitrogen fertilizer, and was still further increased by the application of minerals, in addition to nitrogen. The percentage of nitrogen in the mature plant was not materially changed by the fertilizers.

3. The dry matter from the plat fertilized with the complete fertilizer contained at every period of growth a higher percentage of potash than from the plats fertilized with nitrogen only. The application of minerals alone resulted in a decreased absorption of potash.

4. The percentage of phosphoric acid in the dry matter at the first period was influenced somewhat by the fertilizers. In subsequent growth no difference in the phosphoric acid content was found.

5. The percentages of calcium and magnesium in the total plant were not greatly different at the several periods of growth. The calcium at maturity is stored largely in the leaves, while magnesium migrates to the grain.

6. The hydrolisable carbohydrates vary inversely with the percentage of nitrogen absorbed.

7. The rice plant contains a high percentage of nitrogen, phosphoric acid and potash during early growth, which percentages become gradually reduced during later development.

8. Seasonal variations greatly influence the growth of rice, and likewise produce noteworthy differences in the composition, especially during early growth.

9. The rice plant, by the time it is two-thirds grown, has normally taken up about four-fifths of its maximum nitrogen and phosphoric acid and nine-tenths of its potash, and therefore fertilizers should be applied before planting or at an early period of development. In common with other cereals, rice demands readily available plant food in abundance during early growth.

10. Rice can take up what may be looked upon as an excess of nutrients if these be present in sufficiently large quantities.

11. There is no return to the soil through the roots of rice of nitrogen, phosphoric acid, or potash, and any loss of these sub-

stances that this plant may sustain is most likely traceable to the leaching action of rains and dews.

12. Reducing sugars were found in notable quantities in the rice plant at all stages of growth and were greatest at the first period.

13. Sucrose, while present as a trace at the first period, occurred in the stems at the second period to the extent of 10.38 per cent. At maturity this had been largely converted into starch.

14. Starch gradually increases throughout the growth of the plant and at maturity is stored very largely in the grain.

15. The pentose-forming bodies constitute a large percentage of the carbohydrates of the rice plant at every stage of growth and reach a practical maximum at the flowering stage.

16. Cellulose occurs in large quantities in all parts of the plant, except the grain, and likewise almost reaches a maximum at the second period.

The above conclusions were drawn from a study of two different crops of rice and while the experiments are preliminary, the results should be considered as probable, though not definitely settled. In the near future the practical bearing of these experiments will be set forth in a publication of a more popular nature.

WORK OF THE ENTOMOLOGIST.

The most interesting feature in the work of the enthomology department was the introduction and breeding of parasites against harmful insects. In the study of the pests attacking the cotton, fruit trees, and Leguminosae, employment of artificial remedies has been found impractical, at least on a large scale.

For the first time in the history of rice cultivation in the islands, this cereal was attacked by *Heliophila unipuncta*, serious losses having been reported from all the rice producing sections, the damage at two places amounting to from ten per cent to sixty per cent of the crop.

Outbursts of army worms have been reported from different rice-growing sections of the Philippines. One species has been found by members of the Enthomology class of our College, attacking rice in Sta. Rosa, Laguna, and in Sto. Tomas and Tanawan, Batangas. Investigations already have been undertaken to determine this species.

A synopsis of the Hawaiian Aphidae has been prepared. These small insects, although of great economic importance, have received practically no attention in the Philippines, as was also true in Hawaii. The Enthomology Department there has realized their significance and the synopsis was the result of their work. A key to genera is given, and also the descriptions of twenty-one species, four of which are new. By means of these descriptions it is hoped that the Hawaiian farmers can easily identify the insects when they see them.

THE INFLUENCE OF MANGANESE ON THE GROWTH OF PINEAPPLES

(Press Bulletin No. 23.)

In some of the pineapple soils in Hawaii there are certain black spots where pineapples do not grow successfully. In these spots the pines have a wilted yellow appearance, and the application of fertilizers and lime in conjunction with good tillage and drainage has not resulted in effectually overcoming the yellow appearance of the pines.

Samples of these black soils have been analysed and compared with samples of the red soils where pineapples make a thrifty growth. The following results were found:

1.—The black soils contain less acidity than the red soils.

2.—Only one important difference has been found in the chemical composition of these soils, viz., in regard to the manganese content. The black soils contain many times as much manganese as the red soils. The black color of those areas may in part be attributed to the presence of higher oxides of manganese, the presence of which is evidenced by the hydrochloric acid test.

3.—The black and red spots are not separated by sharp lines of division, but rather gradually merge one into the other. There is, therefore, an intermediate area surrounding the yellow spots on which the pines show the yellowing to a lesser degree. With the view of determining whether the manganese likewise decreases in passing from the black soil to the red, several series of samples from different places were drawn at regular distance apart in passing from the black to the red soil. Analysis of these samples has revealed the fact that there is a close correlation between the degree of

yellowing of the pines and the percentage of manganese in the soil. It has been shown further by the use of the guiacum and aloin tests that the plants grown on black soils are more vigorous oxidizing agents than the plants grown on the red soils. Bertrand found that the ash of oxidizing enzymes contains considerable amounts of manganese, and that the addition of soluble manganese salts to the oxidase greatly accelerated their oxygen carrying power. All the results obtained above seem, therefore, to point out that the etiolated appearance of the pines grown on black soils is brought about by the increased activity of the oxidase due to the presence of large amounts of manganese. Actual oxidation of the chlorophyll seems to take place. An examination under the high power microscope of the cross-section of the yellow leaves shows that for the most part the chlorophyll bodies have been destroyed.

USE OF CARBON BISULPHID FOR KILLING WEEDS

(Press Bulletin No. 20.)

This chemical has been used with success for killing Crotalaria incana, lantana, guava, pricklypear (Opuntia sp.) and Stachytarpheta dichotoma. The carbon bisulphid is poured on the stem at a point about six inches above the surface of the ground. On small stemmed plants like Crotalaria about a tea-spoonful of commercial bisulphid was poured, the amount being increased for larger plants, up to two tablespoonful for guava bushes, eight or ten centimeters in diameter. On most plants carbon bisulphid shows no effect until after the lapse of a considerable period, on large guavas, sometimes two or three months. On others the effect is seen in from one to thirty days. When the trees killed by carbon bisulphid were dug out and examined their roots were found to be dead to the tip and their whole tissue discolored. Apparently, carbon bisulphid causes the death of plants by its freezing effect and also by a poisonous action as evidenced by the complete destruction of the roots to their tips, in some instances more than two meters from the point where the carbon bisulphid was applied.

In working with this chemical, it is always necessary for the workmen to keep to the windward in order to avoid the fumes, which, if inhaled continuously, may produce serious effects. It must be also remembered that the material is highly inflammable and should be protected from accidental flames. In some localities the difficulty of transporting containers may render the method entirely impracticable. On the other hand, the use of carbon bisulphid in the destruction of weeds has the advantage that young sprouts do not come up from the roots. The necessity of grubbing out all the roots is thus obviated. Under such circumstances, it would merely be necessary to allow the weeds to stand until they are dead, after which the trunk and large roots would be removed, as is necessary in any case in clearing the land.

For obvious reasons, carbon bisulphide will never become the usual means of getting rid of weeds. But on a small scale, and specially in dealing with weeds which can grow from fragments left in the ground, it has a use in supplementing other methods. Regarding its effect upon the soil, the balance of the scanty evidence indicates that it is favorable; and this is explained by the recent observation at Rothamstead that it will completely destroy all protozoa in the soil, but not quite all the bacteria on which the protozoa feed. The nitrogen-fixing bacteria, freed of their enemies, multiply rapidly, and soon cause a great increase in the amount of available nitrogen.

USES OF ALGAROBA (TAGALOG, AROMA)

(Press Bulletin No. 26.)

As a forage crop Algaroba (Prosopis juliflora) is of great financial value. The pods are recognized as one of the most important grain feeds of the Islands of Hawaii, and are greatly relished by all kinds of live stock, including chickens. The quantities of pods produced by the algaroba forests can not be estimated even approximately, for a large proportion of the pods are allowed to fall on the ground and are eaten by cattle, hogs and horses, without being previously picked up. It has been estimated that approximately five hundred thousand bags of the beans are annually picked up and stored, particularly for feeding horses and cattle. On two or three estates at least fifteen thousand bags of beans are annually stored for this purpose.

Aroma, which is very like Algaroba, if not identical with it, grows admirably in the Philippines, where it can be found along sea-shores and elsewhere, and with a little labor and practically no expenses an excellent protein diet can be secured

from it. It is time for our farmers to pay more attention to feeding their animals properly, and in these Islands where there is abundant forage stuff, there is no excuse for having laboring animals underfed.

There are other uses of Algaroba. Its wood constitutes one of the best sources of fuel, and the small branches furnish excellent material for making charcoal. The bark contain tannin and is used in the Philippines as a dye stuff; its gum is suitable for use in varnish. The tree itself, being leguminous, is also a soil-maker of some importance. Moreover, the pods contain a high percentage of sugar and may be used in the manufacture of denatured alcohol and vinegar.

MANIOK VARIETIES

Maniok, or cassava, furnishes the staple food of the Samal Moros and of some of their neighbors, occupying the islands to the south and east of Zamboanga and the neighboring shores. In this district the cultivation of the plant is more important than elsewhere in the Philippines, and is naturally better developed. Three varieties are distinguished, and one of these seems to be decidedly the most productive known in the world. A representative of the Government of the Dutch East Indies is reported to have visited Basilan to investigate the plant, and to have found the yield of roots far in excess of that in Java. Single plants, decently cultivated but without fertilization, have produced more than forty kilograms of roots.

Stems of the three varieties were secured by the dean of the college in May last, on the plantation of the Moro Plantation and Development Company near Zamboanga, and planted on the college farm. This first planting was necessarily too small to give results safely interpreted on a plantation scale; but it has already produced stems for a larger area which is expected to yield such results. The three varieties, and their characters as given by the people of their native district, are:

1. Camunting. A small kind, especially sweet, eaten cooked like the sweet potato, and edible even raw. It is practically free of hydrocyanic acid, at any rate when fresh. The petiole is partly green and partly red. The name is the equivalent of "camote," the name of the sweet potato throughout the Philippines.

2. Kapo, called also, by way of distinction to me, kapo colorado. This is the most productive variety, but is not a favorite with the Moros, because it is difficult to make a white flour from it and it is inferior to the camunting for use whole. It is also slow to mature, giving a much greater yield after it grows through a second dry season than at the end of one year. It has not been shown to be more difficult to make white starch from this variety; but the Moros do not make starch. Their flour is made by cleaning, mashing, and drying the roots, and is not kept for any length of time. The petioles of this variety are very red, and the whole plant is reddish.

3. Kapo puti, or as the name is oftener given to outsiders, kapo blanco. This is the favorite variety with the Moros. Its flour is said to be easily made, white, and especially savory. The roots are conspicuously long and narrow, at all stages. It is considered mature within one year. The petioles and entire plant are without a tinge of red. As far as our cultures permit a judgment, this variety seems to be lower-growing, more sprawling, and with more slender stems than the Kapo.

A plant of each variety taken at random in November showed the following weight in fresh roots:

Camunting	1.37 kilos
Kapo	.56 kilo.
Kapo puti	1.54 kilos.

This was at the age of about five months, all during the rainy part of the year. The most rapid development, provided the soil does not dry out, is supposed to be during the dry season.

E. B. C.